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This is a communication from the examiner in charge of your application.
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☒ This application has been examined ☒ Responsive to communication filed on 6/21/95 ☐ This action is made final.

A shortened statutory period for response to this action is set to expire Three(3) month(s), ~~0~~ days from the date of this letter.
Failure to respond within the period for response will cause the application to become abandoned. 35 U.S.C. 133

Part I THE FOLLOWING ATTACHMENT(S) ARE PART OF THIS ACTION:

1. ☒ Notice of References Cited by Examiner, PTO-892.
2. ☐ Notice of Draftsman's Patent Drawing Review, PTO-948.
3. ☐ Notice of Art Cited by Applicant, PTO-1449.
4. ☐ Notice of Informal Patent Application, PTO-152.
5. ☐ Information on How to Effect Drawing Changes, PTO-1474.
6. ☐ _____.

Part II SUMMARY OF ACTION

1. ☒ Claims 45-84, 96, 160-203 are pending in the application.

   Of the above, claims _____ are withdrawn from consideration.

2. ☒ Claims 85-95, 97-159 have been cancelled.
3. ☐ Claims _____ are allowed.
4. ☒ Claims 45-84, 96, 160-203 are rejected.
5. ☐ Claims _____ are objected to.
6. ☐ Claims _____ are subject to restriction or election requirement.
7. ☐ This application has been filed with informal drawings under 37 C.F.R. 1.85 which are acceptable for examination purposes.
8. ☐ Formal drawings are required in response to this Office action.
9. ☐ The corrected or substitute drawings have been received on _____. Under 37 C.F.R. 1.84 these drawings are ☐ acceptable; ☐ not acceptable (see explanation or Notice of Draftsman's Patent Drawing Review, PTO-948).
10. ☐ The proposed additional or substitute sheet(s) of drawings, filed on _____. has (have) been ☐ approved by the examiner; ☐ disapproved by the examiner (see explanation).
11. ☐ The proposed drawing correction, filed _____, has been ☐ approved; ☐ disapproved (see explanation).
12. ☐ Acknowledgement is made of the claim for priority under 35 U.S.C. 119. The certified copy has ☐ been received ☐ not been received ☐ been filed in parent application, serial no. _____ ; filed on _____.
13. ☐ Since this application apppears to be in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under Ex parte Quayle, 1935 C.D. 11; 453 O.G. 213.
14. ☐ Other

EXAMINER'S ACTION

1. Claims 45-84, 96, 160-203 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 45, line 6, and in claim 181, it is unclear what "predominantly" modifies. If it modifies "recovering", it is unclear what "recovering predominantly" means.

In claim 45, line 8, and in claims 50, 83, 84, and 181, it is unclear whether "recovering C60 from said... product" requires any degree of separation of C60 from the "sooty product", or any level of C60 concentration or purity. Similarly, claim 160, last two lines, it is unclear whether "recovering" the material of the respective claims' preamble requires any degree of separation of "carbon allotrope" from the "sooty product", or any level of "carbon allotrope" concentration or purity. Similarly, in claims 160 and 182 and 187 it is unclear whether recovering fullerene from the soot requires any degree of separation of fullerene from the "sooty product" or any level of concentration or purity.

In claims 160 and 181 it is unclear as to how much constitutes "amounts... capable of extracting and recovering... therefrom said allotrope in solid form". For example, if, arguendo, a microgram of C60 was an amount needed to qualify as solid C60, would a process which produced a kilogram of soot which in toto contained microgram C60 (i.e., a parts-per-billion concentration) be within the claims (since 1 microgram C60 is

"capable" of being extracted and "capable" of yielding 1 microgram solid C60? Does the claimed process depend upon what scale it is run, i.e., how much "sooty carbon product" is made or collected, or whether the process is batch or continuous?

The lower limit as to the scope of the claimed "amounts" is indefinite because it is unclear how much of anything is the accepted value to be considered a "solid". Note that a solid particle of colloidal gold can be 1.7 x 10-7 cm in size. Is this the order of magnitude which Applicants intend?

In claims 45, 84, and 181, it is unclear what is the scope of "predominantly ... C60". Would a product containing 2 wt% C60 and 98 other species each at 1 wt% be a product which is "predominantly C60"?

In claim 55, it is unclear whether the product which is recovered in claim 50, step (d) must be crystalline, or whether it can be amorphous but contain crystalline C60.

In claims 58 it is unclear whether the recovery of C70 from the sooty carbon product requires any particular degree of separation of C60 from the sooty carbon product.

In claim 171, it is unclear how a chamber can be "evacuated" and yet simultaneously contain therein "an inert quenching gas", given "evacuated" a normal dictionary definition of "in a vacuum".

In claim 83, lines 4-7, and in claim 84, lines 5-7, it is unclear how a practitioner of the process can know with certainty

whether said practitioner has in possession "amounts sufficient to be capable of providing a ... colored solution", as detection of "colored" depends upon visual acuity, which varies from person to person.

In claim 83, lines 4-7, and in claim 84, lines 5-7, it is unclear as to what is the scope of "amounts (or quantities] [of C60] sufficient to be capable of producing a... colored solution when extracted with sufficient [or effective] amounts of benzene". Would a metric ton of "sooty carbon product" containing a gram of C60 (i.e., a ppm C60 concentration) and extracted with a liter of solvent, be within the scope of the claims, (since quantities on the order of one gram C60 can impart color to solvent quantities on the order of one liter)? Note that the breadth of "extracted" does not preclude portionwise Soxhlet extraction of large quantities of "sooty carbon product" (e.g., metric ton) with small quantities of solvent (e.g., liter). What then is the lower limit of the scope of the claims as to amount of C60?

In claim 160, it is unclear what is a "caged molecule". Does it refer to molecules within clathrates of hydrogen-bonded water molecules?

2. The following is a quotation of the first paragraph of 35 U.S.C. § 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using

> it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

The specification is objected to under 35 U.S.C. § 112, first paragraph, as the specification, as originally filed, does not adequately describe or support the invention as is now claimed; and as failing to adequately teach how to make and/or use the invention, i.e., failing to provide a disclosure which enables the person skilled in the art to which the instantly claimed invention pertains, to make and use an invention commensurate in scope with the claims.

Claims 160 and those which depend from it recite "preparing a carbon allotrope comprising caged molecules consisting solely of carbon atoms which are soluble". However, the specification or originally filed has no written description of "caged molecules"; it merely characterizes that C60 and C70 can be deemed species of "caged molecules". The specification as originally filed had no written description of a genus of "carbon allotrope", only of a "brownish-red allotrope of carbon" or that C60/C70 is an allotrope of carbon. However, two species do not ordinarily support a genus. "Caged molecules" (to the extent the phrase is understood) and "carbon allotrope... capable of being dissolved in non-polar solvents" appears to encompass carbon nanotubes (open and closed), and species such as C76, C80, C82, etc., for

which there is no written description in the original disclosure.

Similarly, new claims 182 and 187 recite a "process for preparing a fullerene". However, there is no written description for the generic term "fullerene", only for the three molecules C60, C70 and C240. Three species do not ordinarily support a genus. It has not been established that the only generic language of the original specification (a "brownish-red carbon allotrope" of original claim 27) is coextensive with "fullerene", since a "brownish-red carbon allotrope" can be a defect-structure diamond or a graphite thin film.

Since the disclosure does not reasonably convey to one of ordinary skill in the pertinent art that the applicants had possession of the generic invention as is now claimed, at the time the application was filed, the claims introduce new concepts and thus contain new matter.

Furthermore, the disclosure does not enable the person skilled in the art to which the instantly claimed invention pertains, to make and use an invention commensurate in scope with the claims, since the specification is not enabled for the preparation of "caged molecules" or "carbon allotrope" or "fullerene" in the amounts specified in claims 160, 182, and 187. The claim embraces the production of tonnage quantities of open or closed carbon nanotubes or C76 or C80, etc. Yet, page 8, lines 1-5 recites, in characterizing Applicants' product, that "the only other large mass found in any abundance corresponds to C70".

Thus even if arguendo the instant disclosure teaches one to make and use trace quantities of open or closed carbon nanotubes or C70 or C80, etc., it clearly does not enable one to make those species in "any abundance", not to mention "in macroscopic amounts".

The specification is also not a commensurately enabling one, because the scope of the claims is broadened from the original disclosure, in that they now embrace formation an isolation of very large quantities of C60 (e.g., one ton), while the original disclosure's literal language only supports the production of C60/70 quantities sufficient to produce coatings that are 2 microns thick. There is no disclosure supporting or describing larger quantities of C60 as are now embraced by the claims.

Claims 45-84, 96 and 160-203 are rejected under 35 U.S.C. § 112, first paragraph, for the reasons set forth in the objection to the specification.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. § 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless --
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 45-46, 50-51, 55-58, 66, 68-71, 73-74, 83-84, 160-168, 171-175, 177-178, 181-191, 195-202 are rejected under 35 U.S.C. § 102(b) as being anticipated by the Huffman article entitled "Measured Extinction efficiency of Graphite Smoke ..."; with the Iijima article (Journal of Phys. Chem.) cited to show inherent states of fact.

Huffman teaches vaporizing carbon from graphite electrodes through which an arc is struck under a pressure of helium gas. A smoke cloud was collected on a substrate held a short distance from the arc. The helium gas inherently acts as a quench gas as it is the same gas used in the same vaporization reaction as that recited in the instant claims (see e.g., claim 74).

See page 50, col. 1, line 39 to col. 2, line 9 of the reference.

The production of C60 in the claimed amounts is inherent in the reference because the positive process steps recited in the process claims are the same.

The Iijima reference is relied upon as evidence of the inherent presence of C60 in Huffman's process. Iijima shows that C60 fullerene is formed in a method in which carbon is evaporated by arc discharge. See page 3466, col. 1, last paragraph. Electron micrographs show a spherical particle of graphite carbon containing the 60-carbon cluster (i.e.; C60 fullerene). See Figure 1a. The cluster appears to be contained within a carbon film formed as a result of the arc discharge, under vacuum.

Thus, because Iijima shows that C60 is formed as a part of a film resulting from arc discharge between carbon rods even under vacuum, then the arc vaporization of the Huffman reference would inherently form at least as much or more C60 since it utilizes an inert quenching gas. The limitation of "recovering C60" is met, to the extent it is understood, because C60 is clearly formed, and the limitation specifies no extent of separation. The C60 is in solid form since the coatings in Huffman are solid. The limitation in claim 50 that a product which is "predominantly C60" is recovered is met because Huffman shows step (a) and (b) of claim 50 as discussed above, as well as step (c) (particles collected on the substrate were studied by electron microscope), then if the claim is considered to be complete (i.e., set forth every necessary step), Huffman must inherently also recover "a product which is predominantly C60 from said sooty carbon product", since the process steps are the same.

Alternatively, note that claim 56/45 shows two steps: (a) vaporizing a carbon source under helium quenching gas "under conditions effective to form... C60 molecules... in amounts capable of extracting and recovering predominantly therefrom said C60 in solid form", followed very simply by (b) recovering substantially pure solid C60. Step(a) of claim 56/45 is sufficiently broad and/or indefinite to embrace C60 formation in amounts equivalent to one colloidal solid particle of carbon.

Iijima shows that spherical particles of graphitized carbon of sizes up to 70 angstroms are inherently made in Huffman's process. (See page 3466, col. 1, lines 18-22). Thus, Huffman makes C60 in the amount required by claim 56/45. Huffman must also inherently make substantially pure solid C60, since the only named step of claim 56 is met. Identical steps result in identical products.

It is noted for emphasis that should Applicants argue that the art which meets the steps is not enabled for the recovery of substantially pure C60, or a product which is predominantly C60, then likewise would claims having the same steps be considered not enabled.

The following is a quotation of 35 U.S.C. § 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.
> Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

Evaluations of the level of ordinary skill in the art require consideration of such factors as various prior art approaches, types of problems encountered in the art, rapidity with which innovations are made, sophistication of technology involved, educational background of those actively working in the field, commercial success, and failure of others.

The "person having ordinary skill" in this art has the capability of understanding the scientific and engineering principles applicable to the claimed invention. The evidence of record including the references and/or the admissions are considered to reasonably reflect this level of skill.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. § 103, the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 C.F.R. § 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of potential 35 U.S.C. § 102(f) or (g) prior art under 35 U.S.C. § 103.

4. Claims 45-84, 96 and 160-203 are rejected under 35 U.S.C. S 103 as being unpatentable over Huffman article entitled, "Measured Extinction Efficiency of Graphite Smoke...", in view of Iijima, and Soviet Patent '000.

Application of the Huffman article and Iijima are as above.

To the extent that the Huffman reference may not identically disclose process conditions of pressure falling within the scope of Applicants' functionally claimed steps, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have evaporated carbon via arc discharge under a helium quenching atmosphere because Huffman shows such a

process, and Iijima teaches that one would expect C60 fullerene to be formed in Huffman's process, and because pressure has been held to be an art recognized, result-effective variable for which it is obvious to find the best value by optimization: See In re Aller, et al. 105 USPQ 233.

Note that the parameter of "pressure" was chosen in the above formulation of the rejection because it is the only parameter which is disclosed in the specification as affecting quantities of fullerene present in the soot. See page 4, lines 16-25 and page 6, lines 8-10. It does not appear that choice of carbon, or carbon heating method, or voltage, or amperage, or type of current, or type of reactor, is disclosed as being critical with respect to quantity of fullerene formed. Should Applicants advance the argument that the references would not enable one to attain whatever the quantity of fullerene the claims require due to the absence of a teaching of some other parameter, note that the instant disclosure also lacks disclosure of a parameter other than pressure which is critical with respect to quantity of fullerene formed.

With respect to claims requiring recovering C60 fullerene in a non-polar benzene or toluene solution, note that the Soviet patent teaches extraction of C60 and C70 compounds from a crude source by toluene and separation of C60 from C70 by chromatography. See entire document. After extraction, the product dissolved therein is weighed. While it is noted that the

reference recovers derivatives of C60 such as C6OLa, it would have been obvious to one of ordinary skill in the art to use the solvent disclosed in the reference to extract underivatized C60 because the substraction of a single La atom from a molecule having 60 carbon atoms in such a structured arrangement would not be expected to drastically alter the solubility properties of the compound.

With respect to sublimation, note that it is well known to sublime organic-soluble species to purify them, and official notice is again taken of same. Since the prior art shows organic solubility to be a characteristic of fullerenes, it would have been obvious to one of ordinary skill in the art to sublime fullerene from either the as-recovered sooty carbon product or the toluene-extracted material of the combined references, process because it is well known to sublime organic-soluble species in order to purify them.

With regards to the "about 100" ampere limitation, note that this value is taught in Iijima as being operable for fullerene formation, and it would have been obvious to run the Huffman process at that current in order to evaporate carbon to form a carbon coat.

With respect to the "bell jar carbon evaporator" limitation, note that this appears to be a conventional apparatus element.

With respect to the limitation as to "glass" substrate, note that Huffman shows a silica substrate, which appears to

reasonably suggest the limitation because glass is principally comprised of silica. With respect to the distance of the substrate from the vaporization source, note that while what is claimed is not identically disclosed in Huffman, it would have been obvious to determine the optimum distance because, Huffman is directed to collecting particulate soot on the substrate and distance would be an obvious parameter to optimize.

5. Claims 45-54, 57, 62, 63, 76-80, 83-84, 160-163, 169, 179, 180-183, 187-188, 192-193 and 203 are rejected under 35 U.S.C. § 103 as being unpatentable over Yoshimura (US Patent 4,808,395) in view of Reck (US 4,435,378); with Shigematsu (Idemitsu Tokohu article) cited only to show inherent states of fact.

Yoshimura is relied upon to teach the steps of vaporizing a carbon source such as a hydrocarbon, in the "presence of" an inert quenching gas (namely, the nitrogen component of air) under conditions effective to form sooty "furnace black", i.e., carbon black. See col. 1 lines 9-15 and col. 5, lines 1-44. The furnace black is made at a rate exceeding 55 kg per hour. See table 1.

Yoshimura differs from the instant claims in not reciting a step of "recovering C60 in macroscopic amounts from said sooty carbon product" (to the extent the limitation is understood), such as by recovering said C60 "in solution" of benzene or toluene (see instant claims 47-49 and 52-54).

Reck teaches that one can purify furnace carbon black to remove extractable components including polycyclic aromatic hydrocarbons, by Soxhlet extract of the carbon black with solvents such as boiling toluene. See col. 1, lines 23-69.

The Shigematsu reference is relied upon to show that inherently the furnace carbon black contains 1.6 ppm C60 in a form which is capable of being extracted and recovered therefrom in solution of toluene by Soxhlet extraction with toluene. Shigematsu teaches that a ten-hour Soxhlet extraction of 3 kg conventional carbon black synthesized in large quantities from petroleum which is partially combusted and then cooled with sprays of water, can yield 5 milligrams of a substance which is essentially C60. See pages 3-4 of translation.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have continuously extracted 3 kg or greater of furnace carbon black made by the process shown in Yoshimura, by toluene, in order to remove extractables and thereby "purify" the furnace black for sale, because Reck teaches that these extractables can be removed by such extraction and because Yoshimura teaches making at least 55 kg of the furnace black per hour. In an industrial scale furnace black manufacturing-purification process, enough C60 would be made to more than satisfy the claim limitation that the C60 present therein is present "in amounts capable of extracting and recovering predominantly therefrom ... C60 in macroscopic amounts

and in solid form", since Shigematsu shows that inherently, enough is in carbon black to meet the limitation. Note that the claims require no concentration for C60 in the initially formed soot and therefore do not distinguish over the references. The extraction step suggested by Reck would constitute a recovery of macroscopic amounts of C60, since upon a complete extraction of 55 kg of furnace carbon black, (for the purpose of "purifying" it), 92 milligrams (clearly a macroscopic amount) of C60 would be recovered.

To get the C60 in solid form as required by instant claim 46, note that it would have been obvious to distill off the extraction solvent used in the above described combination of references in order to reuse the solvent, thereby leaving a solid comprising C60 behind.

Note that the bag filter for collecting carbon black shown in Yoshimura, col. 6, line 1, can fairly be deemed a substrate for collecting a sooty carbon product.

Note that the extraction suggested by the Reck reference would meet the purification step broadly claimed in claim 79 because claim 80 recites that the "purifying step is extraction".

6. Claims 45-46, (68-71)/45, (73-74)/45, 83, 160-163, (167-168)/163, 172-175, 177-178, 181-191, 195-202 are rejected under 35 U.S.C. 102(b) as being anticipated by Bacon (US Patent 2,957,756).

Bacon strikes an arc from a graphite rod to a graphite block, all under an argon atmosphere of 1360 pounds per square inch, using 80 volts direct current, 60 amperes per square inch. What was isolated were carbon filaments of crystal perfection approaching that of single crystals. See col. 2, lines 18-60. The conditions performed in Bacon were the same as those which the instant specification states are effective to form C60 fullerene ("the pressure can be raised to any level just below the point where the reactor would explode"; page 4, line 31- page 5, line 1), therefore Bacon must have inherently made C60 fullerene to the same extent as in the rejected claims. Whatever C60 was made was solid after cooling.

Bacon also most distinctly meets the limitations of claims 181, 182, 187 because "caged molecules consisting solely of carbon atoms", and "fullerenes" as written, are terms which are sufficiently broad to embrace the "large graphite sheets rolled up into a tight tube" explicitly formed by Bacon (col. 3, lines 15-20).

7. Claims 45-46, 50-51, 58, 66, 68-75, 83-84, 160-163, 171-178, 181-191, 195-202 are rejected under 35 U.S.C. S'102(b) as being anticipated by Kappler article entitled "Fine Carbon Particle Formation by Carbon-Vapor Condensation".

Kappler produces carbon vapor by electrically heating

graphite rods at 100-110 amperes under at atmosphere of 30 torr argon. Pyrex glass substrates at 4 cm distance from the evaporation collects aggregates of particulate carbon deposits. See pg. 308, col. 2, lines 18-38, pg 309, col. 2, last 5 lines and pg. 310, col. 1.

Kappler inherently produces C60 fullerene in the amounts claimed because it evaporates the same graphite rods through which is run the same current under the same inert atmosphere and collects carbon particles on the same substrate at the same distance from the vaporization, as in the instantly rejected claims. The obtention of the carbon deposit per se qualifies as the C60 recovery of claim 45 (since no separation is required), and the substantially pure C60 limitation of claims 50-51 is inherently met because the positive process steps are the same.

8. Applicant's arguments filed 21 June 1995 have been fully considered but they are not deemed to be persuasive.

Applicants argue that the term "macroscopic" is defined in the art, and that support for the term "permeate the specification", and point out the sections of the specification where a color of a substance is observed, and where a 2 micron thick film is observed. Thus, presumably since there may be an example directed to an instance where a "macroscopic" amount of

C60 was prepared, then Applicant is fairly entitled to use the term in the claims.

However, while the term is accepted as having meaning, the term itself is absent from the specification (i.e., no written description), and the meaning of the term is of a scope which the specification does not enable (i.e., no *commensurate* enabling disclosure). The term embraces the production of a sooty carbon product made entirely of C60, or of tonnage quantities of C60, while the specification only supports the production of a two micron thick coating, or of a sooty carbon product which contained a "few" percent of C60/C70.

Applicants point to paragraphs 14-15 of the Kroto declaration, which state that in the published papers of Prof. Kroto, the "breakthrough made by Huffman and Kratschmer" is aptly and correctly characterized as one which makes "macroscopic" C60/C70.

However, while the statements of the esteemed Prof. Kroto in declaration para. 14 have been fully considered, they state the opinion that, after the fact (i.e., after the Huffman-Kratschmer experiment of 1990), Prof. Kroto evinced the concept that the "breakthrough made by Huffman and Kratschmer" is aptly and correctly characterized as one which makes "macroscopic" C60/C70, i.e, Prof. Kroto realized this implication. In other words, the Kroto declaration does not establish that the instant application itself, as filed and in view of only its state of the art,

reasonably conveys the concept that the inventors were in possession of a method which can make tonnage quantities of C60/C70, not to speak of any other fullerenes, which were explicitly not made in any abundance. (See instant page 8, lines 1-5 which recites, in characterizing Applicants' product, that "the only other large mass found in any abundance corresponds to C-70"). As to declaration paragraph 15, while Prof. Kroto expressed the professional opinion that the instant inventors "had in their possession macroscopic amounts" of C60, this may only be true of physical possession of one amount, of one or two fullerenes (viz, C60 and C70), which can be deemed "macroscopic", not conceptual possession of all amounts which can be deemed "macroscopic" of all fullerenes (such as the undescribed but later-discovered C78, C82, metallofullerenes, carbon onions, and closed carbon nanotubes).

Applicants argue, in their response, that the concept of "fullerene" also permeates the instant specification, since all three of the only disclosed species (viz. C60, C70, and C240) can all be considered fullerenes. Further, Applicants look to the Kroto declaration (para. 15 and 16) and the dictionary definition of fullerene to assert that "there is implicit support for these concepts and terms in the application upon which to base generic claim language".

However, three species do not ordinarily support a genus. While it is clear that the specification makes some amount of

three molecules, all of which can be termed as fullerenes does not necessarily mean that the specification is enabled for the synthesis of all fullerenes. There is no written description for this genus of all "fullerenes", and it has not been established that the only generic language of the original specification (a "brownish-red carbon allotrope" of original claim 27) is coextensive with "fullerene", since a "brownish-red carbon allotrope" can be a defect-structure diamond or a graphite thin film. As a simple analogy, it can be observed that the three species of molecules are all elemental carbon, yet by virtue of this alone it cannot be asserted that the specification is enabled for the production of all elemental carbon substances, such as diamond.

As to the language of Prof. Kroto (declaration para. 15), he states that the application teaches the "skilled artisan" how to make "macroscopic amounts of fullerene, including C60 and C70", but he does not state whether the application teaches the "skilled artisan" how to make all "macroscopic" amounts of completely undisclosed fullerenes.

The In re Smythe decision allowing generic terminology from species in a specification does not appear to be on point, since said decision allowed for claiming generically all things which were "obviously art recognized equivalents" of the species orignally disclosed. The question is asked rhetorically, what are the "obviously art recognized equivalents" of C60, C70 and C240,

taking only into account the state of the art at the time of the instant application. It is certain that whatever those equivalents may be, they cannot include those fullerenes which were only discovered by surprise in 1991 or thereafter. Yet the claims claim them all.

Applicants argue, (at page 13, lines 16-31), that the "preparation of other fullerenes can be practiced by the skilled artisan using the methodology therein by modifying the parameters without an undue amount of experimentation".

This however, is not supported by the application as filed. the original specification does not even mention any of the other possible fullerenes besides C60, C70 and C240, let alone mention the genus, and so it would constitute undue experimentation for one to modify the parameters of the instant application in order to arrive at species which are not hinted at in the specification; there is no guidance leading even to the desire to make other species of fullerenes in macroscopic amounts, let alone how to do so.

Now with regards to the rejections under the second paragraph of 35 USC 112, applicants argue that there is no ambiguity in the language that "one obtains macroscopic amount of product from the soot".

However, it is still indefinite what is the scope of recovering macroscopic amounts of product from the soot. Is any

degree of separation from the remainder of the soot required? If the soot had a gram of C60 (one possible macroscopic amount) intimately admixed with a tonne of graphite, and the product recovered from the soot consisted of a gram of C60 (one possible macroscopic amount) intimately admixed with a tonne of graphite, would it be within the scope of the claims? In other word, must all of the "macroscopic" amount be concentrated in one place?

Applicants argue that the amounts of C60 connoted by "C60 molecules present in the soot in such quantities that C60 can be extracted and recovered predominantly therefrom as a solid" or "a colored solution would result when the soot is extracted with benzene", are clear. Applicants further argue that "this language connotes to the skilled artisan that appreciable amounts of product, i.e., macroscopic amounts, are present in the soot in order for these characteristics to be observed".

However, this argument is rebutted in the publication of Shigematsu, which establishes that a ten-hour Soxhlet extraction of 3 kg conventional carbon black can yield 5 milligrams of a substance which is essentially C60: an extraction of a macroscopic amount of C60 from a material having about 1.6 ppm target product. It is unclear whether the claim language of claim 45 ("said C60 molecules being present in said sooty carbon product in amounts capable of extracting and recovering therefrom said C60 in macroscopic amounts and in solid form") embraces a soot having about 1.6 ppm C60 in it.

Applicants argue that "Claim 58 only requires that C70 is recovered from the soot. Again the metes and bounds thereof are sufficiently understood to the skilled artisan".

However, the rejection of the word "recovered" or "recovering" under 35 USC 112, second paragraph, is continued, because it remains unclear, in all the pertinent claims, whether "recovering C60 from said... product" requires any degree of separation of C60 from the sooty product, or any level of C60 content or purity.

Applicants argue that the Huffman reference applied above does not teach or claim to teach making C60 or C70 or any other fullerene. However, the inherent presence of C60 therein is not predicated upon what the author of the reference was cognizant of in at the time the reference was published. Applicants have neither presented reasoning nor evidence as to why a process such as those of the Huffman or Kappler reference (both of which vaporize graphite under an inert gas) do not or are incapable of producing C60 in the claimed quantities.

Applicants point to the Kroto declaration at paragraph 9, which states that in the professional opinion of the declarant, the reference documents "do not teach methods for the production of fullerenes, including C60", and that any assertion that C60 was made in the references, "would be entirely speculative and unsupported".

However, for those broad claims which require no particular C60 concentration in the initially formed soot and no separation of C60 from the soot, it must be concluded that the Kappler and Bacon and Huffman references must have made C60, since the references disclose the same steps as are in the claims, unless there is something left out of the claims which make the "vaporizing of a carbon source in the presence of argon" of the claims different from the same step shown in, e.g. Kappler or Bacon or Huffman. Furthermore, where the Bacon reference makes closed carbon nanotubes, it appears that the claims broadly requiring "fullerenes" rather than just C60 are even more fully met.

Applicants argue that the conclusion of Iijima (that C60 is made by evaporation of carbon rods in vacuo) is "entirely speculative and unsupported".

However, the method used in Iijima to reach the conclusion (namely, observation of a sphere of carbon of the requisite size via high resolution microscopy) is the same one Applicants use to conclude that they made C240 (see instant page 11, lines 15-21), so the conclusion of Iijima does not appear to be any more speculative than that of the Applicants.

Applicants argue that they have antedated the Soviet '000 reference, since Applicants' September 1990 article in the journal "Nature" was received by the editors of "Nature" prior to the publication date of the Soviet '000 reference.

However, this is not convincing as a proof of prior invention, since the acts relied upon therefor must be "in this country", and this has not been alleged, let alone sworn to or declared under 37 CFR 1.131. Further, note that "Nature" is a UK publication, further indicative of acts outside this country.

9. Any inquiry concerning this communication should be directed to Peter DiMauro at telephone number (703) 308-0680.

pd
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